DETAILED ACTION

Allowable Subject Matter

1. Claims 1 - 15 are pending, of which claims 1 - 9 and 15 are independent. Claims 5, 7, and 9 have been amended. Claims 16 - 23 have been withdrawn.

2. The following is an examiner's statement of reasons for allowance. The bolded text below indicates the claim language that distinguishes Applicants' invention from the art of record.

For claim 1, none of the art of record teaches an electrostatic suction type fluid discharge device, in which drive voltage supply means supplies a drive voltage between a nozzle and a discharge target and hence an electric charge is applied to a fluid supplied into the nozzle, so that the fluid is discharged as droplets from a hole of the nozzle to the discharge target,

the hole of the nozzle falling within a range between φ0.01μm and φ25μm in diameter, and

the drive voltage supply means outputting, as the drive voltage, a bipolar pulse voltage which has a frequency of not less than 1 Hz, and which alternates between positive and negative **such that positively charged fluid droplets and negatively charged fluid droplets are alternately discharged in accordance with a polarity of the bipolar pulse voltage applied as the drive voltage and alternately landed on the discharge target**.

For claim 2, none of the art of record teaches an electrostatic suction type fluid discharge device, in which drive voltage supply means supplies a drive voltage between a nozzle and a discharge target and hence an electric charge is applied to a fluid supplied into the nozzle, so that the fluid is discharged as droplets from a hole of the nozzle to the discharge target,

the hole of the nozzle falling within a range between φ0.01μm and φ25μm in diameter, and

the drive voltage supply means outputting, as the drive voltage, a bipolar pulse voltage which alternates between positive and negative **such that positively charged fluid droplets and negatively charged fluid droplets are alternately discharged in accordance with a polarity of the bipolar pulse voltage applied as the drive voltage and alternately landed on the discharge target**, and which satisfies $f \leq 1/(2\tau)$ where τ is a time constant determined by $\tau = \varepsilon/\sigma$, f is a drive voltage frequency (Hz), σ is an electric conductivity (S/m) of the discharge fluid, and ε is a relative permittivity of the discharge fluid.

For claim 3, none of the art of record teaches an electrostatic suction type fluid discharge device, in which drive voltage supply means supplies a drive voltage between a nozzle and a discharge target and hence an electric charge is applied to a fluid supplied into the nozzle, so that the fluid is discharged as droplets from a hole of the nozzle to the discharge target, and the nozzle and the discharge target are moved in a

relative manner by shifting means, in a direction orthogonal to a direction along which the nozzle and the discharge target oppose to each other,

the hole of the nozzle falling within a range between φ0.01μm and φ25μm in diameter,

the drive voltage supply means outputting, as the drive voltage, a bipolar pulse voltage which has a frequency of f Hz and which alternates between positive and negative **such that positively charged fluid droplets and a negatively charged fluid droplets are alternately discharged in accordance with a polarity of the bipolar pulse voltage applied as the drive voltage and alternately landed on the discharge target**, and

the electrostatic suction type fluid discharge device further comprises control means that controls at least one of the drive voltage supply means and the shifting means in such a manner as to satisfy f ≥ 5v where f is a drive voltage frequency (Hz) of the drive voltage supply means and v indicates a relative speed (μm/sec) of the relative movement of the nozzle and the discharge target.

For claim 4, none of the art of record teaches an electrostatic suction type fluid discharge device, in which drive voltage supply means supplies a drive voltage between a nozzle and a discharge target and hence an electric charge is applied to a fluid supplied into the nozzle, so that the fluid is discharged as droplets from a hole of the nozzle to the discharge target, and the nozzle and the discharge target are moved in a

relative manner by shitting means, in a direction orthogonal to a direction along which the nozzle and the discharge target oppose to each other,

the hole of the nozzle falling within a range between φ0.01μm and φ25μm in diameter, and

the drive voltage supply means outputting, as the drive voltage, **a bipolar pulse voltage which is not more than 400V and which alternates between positive and negative such that positively charged fluid droplets and negatively charged fluid droplets are alternately discharged in accordance with a polarity of the bipolar pulse voltage applied as the drive voltage and alternately landed on the discharge target**.

For claim 5, none of the art of record teaches an electrostatic suction type fluid discharge method, in which

a drive voltage is supplied between a nozzle and a discharge target and hence an electric charge is applied to a fluid supplied into the nozzle, so that the fluid is discharged as droplets from a hole of the nozzle to the discharge target,

the hole of the nozzle falling within a range between φ0.01μm and φ25μm in diameter, and

the drive voltage being a bipolar pulse voltage which has a frequency of not less than 1 Hz and alternates between positive and negative **such that positively charged fluid droplets and a negatively charged fluid droplets are alternately discharged in accordance with a polarity of the bipolar pulse voltage applied as the drive**

voltage and alternately landed on the discharge target.

For claim 6, none of the art of record teaches an electrostatic suction type fluid discharge method, in which

a drive voltage is supplied between a nozzle and a discharge target and hence an electric charge is applied to a fluid supplied into the nozzle, so that the fluid is discharged as droplets from a hole of the nozzle to the discharge target,

the hole of the nozzle falling within a range between φ0.01μm and φ25μm in diameter, and

the drive voltage being a bipolar pulse voltage which alternates between positive and negative **such that positively charged fluid droplets and negatively charged fluid droplets are alternately discharged in accordance with a polarity of the bipolar pulse voltage applied as the drive voltage and alternately landed on the discharge target**, and which satisfies $f \leq 1/(2\tau)$ where τ is a time constant determined by $\tau = \varepsilon/\sigma$, f is a drive voltage frequency (Hz), σ is an electric conductivity (S/m) of the discharge fluid, and ε is a relative permittivity of the discharge fluid.

For claim 7, none of the art of record teaches an electrostatic suction type fluid discharge method, in which

a drive voltage is supplied between a nozzle and a discharge target and hence an electric charge is applied to a fluid supplied into the nozzle, so that the fluid is discharged as droplets from a hole of the nozzle to the discharge target, and the nozzle

and the discharge target are moved in a relative manner, in a direction orthogonal to a direction along which the nozzle and the discharge target oppose to each other,
the hole of the nozzle falling within a range between φ0.01μm and φ25μm in diameter, as the drive voltage, a bipolar pulse voltage which has a frequency of f Hz being outputted and alternates between positive and negative **such that positively charged fluid droplets and a negatively charged fluid droplets are alternately discharged in accordance with a polarity of the bipolar pulse voltage applied as the drive voltage and alternately landed on the discharge target**, and

at least one of the drive voltage frequency f Hz and a relative speed vμm/sec of the relative movement of the nozzle and the discharge target being controlled in such a manner as to satisfy $f \geq 5v$.

For claim 8, none of the art of record teaches an electrostatic suction type fluid discharge method, in which

a drive voltage is supplied between a nozzle and a discharge target and hence an electric charge is applied to a fluid supplied into the nozzle, so that the fluid is discharged as droplets from a hole of the nozzle to the discharge target,

the hole of the nozzle falling within a range between φ0.01μm and φ25μm in diameter, and

the drive voltage being a bipolar pulse voltage which is not more than 400V and which alternates between positive and negative **such that positively charged fluid droplets and negatively charged fluid droplets are alternately discharged in**

accordance with a polarity of the bipolar pulse voltage applied as the drive voltage and alternately landed on the discharge target.

For claim 9, none of the art of record teaches an electrostatic suction type fluid discharge device that

(i) discharges, by electrostatic suction, a discharge fluid as droplets through a

fluid discharge hole of a nozzle of a fluid discharge head, the discharge fluid being electrically charged by voltage application, and (ii) causes the discharge fluid to land onto a substrate, (iii) so as to form a drawing pattern by the discharge fluid on a surface of the substrate,

the fluid discharge hole of the nozzle falling in a range between 0.01μm and 25μm in diameter, and

the substrate being insulating, the electrostatic suction type fluid discharge device comprising:

charge removal means for removing an electric charge on the surface of the substrate, before the discharge fluid is discharged onto the substrate; and

fluid discharge means for discharging the droplets of discharge fluid onto the substrate from which the electricity has been removed by a bipolar pulse voltage which alternates between positive and negative **such that positively charged fluid droplets and negatively charged fluid droplets are alternately discharged in accordance with a polarity of the bipolar pulse voltage applied as the drive voltage and alternately landed on the substrate**.

Since claims 10 - 14 depend from allowed independent claim 9, they are allowed.

For claim 15, none of the art of record teaches an electrostatic suction type fluid discharge method in which

(i) by electrostatic suction, a discharge fluid is discharged as droplets through a fluid discharge hole of a nozzle of a fluid discharge head, the discharge fluid being electrically charged by voltage application, and (ii) the discharge fluid droplets are caused to land onto a substrate, (iii) so that a drawing pattern is formed by the discharge fluid droplets on a surface of the substrate,

the fluid discharge hole of the nozzle falling in a range between 0.01μm and 25μm in diameter, and

the substrate being insulating, an electric charge on the surface of the substrate being removed, before the discharge fluid is discharged onto the substrate, and

the discharge fluid being discharged onto the substrate from which electricity has been removed by a bipolar pulse voltage **such that positively charged fluid droplets and negatively charged fluid droplets are alternately discharged in accordance with a polarity of the bipolar pulse voltage applied as the drive voltage and caused to alternately land on the substrate**.

Any comments considered necessary by Applicants must be submitted no later than the payment of the issue fee and, to avoid processing delays, should preferably

accompany the issue fee. Such submissions should be clearly labeled "Comments on Statement of Reasons for Allowance."

Conclusion

Any inquiry concerning this communication or earlier communications from the examiner should be directed to Alexander C. Witkowski whose telephone number is (571) 270-3795. The examiner can normally be reached on Monday to Saturday, 8:00 AM to 6:30 PM EST, except on Tuesday to Thursday of alternate weeks.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Stephen D. Meier can be reached on 571-272-2149. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see http://pair-direct.uspto.gov. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free). If you would like assistance from a USPTO Customer Service Representative or access to the automated information system, call 800-786-9199 (IN USA OR CANADA) or 571-272-1000.

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